ENGINEERING EVALUATION REPORT
CITY OF FAIRFIELD
PLANT NUMBER 1606
APPLICATION NUMBER 6453

I. BACKGROUND

The City of Fairfield has a natural gas fired generator that provides electrical power for the city administrative complex. Excess power is sent to the local grid. This engine does not have turndown capabilities, so there is always power being sent to the grid, with minimal compensation. Chevron Energy Solutions performed an audit of the facility and recommended that the existing engine be replaced with a new one that provides a superior interconnect with the power usage of the facility ("free" power to the local grid would be minimized). This source is:

S-2 Natural Gas Fired Lean Burn IC Engine with CO Oxidation Unit and SCR with Ammonia Catalyst

This new engine will be installed in the location of the existing S-1 engine, which will be discarded.

The application fees have been paid by Chevron Energy Solutions with Log # H814G.

II. EMISSION CALCULATIONS

Operating Conditions:

Fuel: Natural Gas
Maximum Firing Rate: 8,400,000 Btu/hr
Annual Fuel Usage: 735,840 therms
Abatement: Miratech CO Oxidation Catalyst (**A-1**) and SCR Unit (**A-2**)
Engine Type: 4-stroke V-16, 4211 cu. in., lean burn spark ignition.
Engine Power (Maximum/Operating): 1148/1085 Bhp
Operation: 24 hr/day, 7 day/wk, 52 wk/yr (8760 hr/yr)

Emissions Data:

NO_x: 0.90 g/Bhp-hr; 83.3% abatement with SCR unit
CO: 2.5 g/Bhp-hr; 76% abatement with an oxidation catalyst
SO_x: 5.88E-04 lb/MMBtu fuel input from AP-42 table 3.2-2
PM: 7.71E-05 lb/MMBtu fuel input from AP-42 table 3.2-2
POC: 0.50 g/Bhp-hr; 70% abatement with an oxidation catalyst

1. Uncontrolled Natural Gas Fired Emissions:

Pollutant	E.F.	Max Power	Emissions	Emissions	Emissions	Emission
	(g/Bhp-hr)	(Bhp)	(lb/hr)	(lb/day)	(lb/yr)	(ton/yr)
NO_x	0.90	1148	2.28	54.7	20,000	10.0
CO	2.5	1148	6.33	152	55,400	27.7
POC	0.50	1148	1.27	30.4	11,100	5.5

Lb/hr = EF x Bhp / 453.6g/lb

2. Abated Natural Gas Fired Emissions:

Pollutant	E.F.	Max Power	Abatement	Emissions	Emissions	Emission	Abated E.F.
	(g/Bhp-hr)	(Bhp)	%	(lb/day)	(lb/yr)	(ton/yr)	(g/Bhp-hr)
NO_x	0.90	1148	83.3	9.1	3,330	1.67	0.15
CO	2.5	1148	76	36.4	13,300	6.65	0.60
POC	0.50	1148	70	9.1	3,330	1.67	0.15

Lb/yr = EF x Bhp / 453.6g/lb x [1-abatement] x 8760hr/yr

3. Other Criteria Pollutant Emissions

Pollutant	E.F.	Heat Release	Emissions	Emissions	Emission
	(lb/MMBtu)	(MMBtu/hr)	(lb/day)	(lb/yr)	(ton/yr)
SO_x	5.88E-04	8.4	0.119	43.3	0.022
PM_{10}	7.71E-05	8.4	0.02	5.67	0.003

4. Toxic Emissions

Toxic	E.F.	Abatement	Emissions	Toxics Trigger
Pollutant	Lb/MMBtu	%	(lb/yr)	(lb/yr)
1,1,2,2-Tetrachloroethane	4.00E-05	70	0.88	3.3
1,1,2-Trichloroethane	3.18E-05	70	0.35	12
1,1-Dichloroethane	2.36E-05	70	0.26	120
1,2-Dichloroethane	2.36E-05	70	0.26	
1,2-Dichloropropane	2.69E-05	70	0.30	
1,3-Butadiene	2.67E-04	70	5.89	1.1
1,3-Dichloropropene	2.64E-05	70	0.29	
Acetaldehyde	8.36E-03	70	184	72
Acrolein	5.14E-03	85	56.7	3.9
Benzene	4.40E-04	70	9.71	6.7
Butyr/isobutyraldehyde	1.01E-04	70	2.23	
Carbon Tetrachloride	3.67E-05	70	0.41	4.6
Chlorobenzene	3.04E-05	70	0.34	14000
Chloroform	2.85E-05	70	0.31	36
Ethane	1.05E-01	70	2317	
Ethylbenzene	3.97E-05	70	0.44	
Ethylene Dibromide	4.43E-05	70	0.49	2.7
Formaldehyde	5.28E-02	80	777	33
Methanol	2.50E-03	70	55.2	120000
Methylene Chloride	2.00E-05	70	0.44	190
Naphthalene	7.44E-05	70	0.82	270
PAH	2.69E-05	70	0.59	0.044
Styrene	2.36E-05	70	0.26	140000
Toluene	4.08E-04	70	9.01	39000
Vinyl Chloride	1.49E-05	70	0.16	2.5
Xylene	1.84E-04	70	4.06	58000

Note: Toxic emission factors are from AP-42, Fifth Edition, Table 3.2-2. Emissions for underlined pollutants are discounted 50% to allow for the low rating on the AP-42 EF. Shaded emissions exceed trigger level.

5. PAH Emissions.

Toxic Pollutant	E.F. Lb/MMBtu	Abatement %	Emissions (lb/yr)	Toxics Trigger (lb/yr)
Benzo(a)anthracene	9.60E-05	70	2.08E-03	4.4E-02
Benzo(a)pyrene	5.17E-05	70	1.12E-03	4.4E-02
Benzo(k)fluoranthene	1.07E-03	70	2.32E-02	4.4E-02
Benzo(b)fluoranthene	9.29E-04	70	2.01E-02	4.4E-02
Dibenz(a,h)anthracene	1.47E-05	70	3.18E-04	4.4E-02
Indeno(1,2,3-cd)pyrene	2.95E-04	70	6.38E-03	4.4E-02

Note: Toxic emission factors are from Catef database http://arbis.arb.ca.gov/emisinv/catef/catef.htm

6. Ammonia Emissions

The ammonia (NH3) mass emission rate from the turbine will be limited by permit condition to 10.0 ppmv, dry @ 15% O2. The NH3 mass emission rate based on the maximum firing rate of the turbine is calculated as follows based on 10.0 ppmv @ 15% O2:

(10 ppmvd)(20.95-0)/(20.95 – 15) = 35.2 ppmv NH3, dry @ 0% O2

$(35.2/10^6)$(lbmol/385.3 dscf)(17.0 lb NH3 /lbmol)(8600 dscf/MMBtu) = .0134 lb/MM

(0.0134 lb NH3/MMBtu)(8.4 MMBtu/hr) = 0.11 lb NH3/hr = 2.69 lb/day

III. EXEMPT OPERATIONS

None

IV. LIST OF SOURCES

The following source requires a Permit to Operate from the District in accordance with Regulations 2-1-301 and 2-1-302:

S-2 Natural Gas Fired Lean Burn IC Engine with CO Oxidation Unit and SCR with Ammonia Catalyst

V. CUMULATIVE EMISSIONS

The cumulative emissions actually decrease for this application. The current emissions are from the existing S-1 engine that was first permitted in 1983. The NOx, CO and POC emissions are based on the 1983 evaluation calculations by Ellen Garvey (Application 29026). The PM10 and SOx emissions are from the current calculations in databank. The S-1 emissions are shown as negative since this engine will be removed from service and replaced by S-2 engine.

City of Fairfield Plant 1606 Cumulative Emissions

	Current S-1	*Increase S-2*	*Total Net*
Pollutant	***ton/yr***	***ton/year***	***ton/year***
NO_x	-21	1.67	-19.33
CO	-32	6.65	-25.35
POC	-8	1.67	-6.33
PM_{10}	-0.37	0.003	-0.37
SO_2	-0.02	0.022	0.00
NH_3	0	0.49	0.49

VI. APPLICABLE REQUIREMENTS

The sources covered in this application are not currently subject to National Emission Standards for Hazardous Air Pollutants (NESHAPS) or NSPS (New Source Performance Standards).

This project is within 1000 feet of four schools and therefore is subject to the public notice requirement of Regulation 2-1-412. According to the school program, there is an additional school within ¼ mile of the site. The applicant believes that this fifth school is farther than ¼ mile from the source, but has yet to provide sufficient information that demonstrates this fact. If this information is not provided in a timely manner, the fifth school will be included in the public notice.

A. Toxic Risk Assessment

The engine emits toxic compounds in quantities that exceed the risk screen trigger levels. Therefore, a toxic risk screen was performed. The results are summarized below:

Health Risk Results		
Receptor	Maximum Increased Cancer Risk	Hazard Index
Residential	5 chances in a million	0.9
We R Family School	0.004 chances in a million	0.003
Fairfield Montessori School	0.006 chances in a million	0.004
Community Day School	0.006 chances in a million	0.004
Fairfield Suisun Adult School	0.006 chances in a million	0.004

These health risk levels are acceptable under the District's Risk Management Policy.

B. New Source Review - Regulation 2, Rule 2

1. Best Available Control Technology Requirements (2-2-301)

A Best Available Control Technology (BACT) review is required for any new or modified source that results in a cumulative emissions increase for POC, NPOC, NO_x, SO_2, PM_{10}, or CO of greater than 10 pounds per highest day. This engine emits NO_x, CO and POC at a rate higher than 10 lb/day.

The currently published BACT for this engine is shown in the BACT Handbook on page 96.3.1. However, the consultant for this applicant, SCEC, was provided a draft copy of a proposed revision to the BACT requirements (on Application 4436). The consultant believed this to be the

current approved BACT and requested all vendor performance guarantees to meet this draft BACT guideline. Here is a summary of the BACT requirements:

	96.3.1 BACT 1	**96.3.1 BACT 2**	**Proposed BACT1**	**Proposed BACT2**
NOx:	0.30 g/Bhp-hr	1.0g/Bhp-hr	0.07 g/Bhp-hr	0.15g/Bhp-hr
CO:	0.50 g/Bhp-hr	2.75g/Bhp-hr	0.10 g/Bhp-hr	0.60g/Bhp-hr
POC	0.60 g/Bhp-hr	1.0g/Bhp-hr	n/d	0.15g/Bhp-hr

The Proposed BACT guidelines are used in this BACT analysis and are summarized in the following table:

Pollutant	***S-2 Uncontrolled***	***S-2 Abated***	***Proposed BACT 2)***
	g/Bhp-hr	***g/Bhp-hr***	***g/Bhp-hr***
NO_x	0.90	0.15	0.15
CO	2.5	0.60	0.60
POC	0.50	0.15	0.15

As can be seen in the table above, this source is in compliance with the proposed BACT 2 emission standards.

The applicant performed a cost estimate to install abatement to meet the proposed BACT 1 requirements. The major impact of additional abatement is that it would not fit in the existing building so a significant building modification would be required. The cost to install these additional facilities is estimated at $287,000.

The NOx BACT 1 emissions would be as follows:

(0.07 g/Bhp-hr) X (1148 BHP) / (453.6 g/lb) = 0.177 lb/hr
(0.177 lb/hr) X (8760 hr/yr) / (2000 lb/ton) = 0.78 tons/yr

Using the 1.67 tons/yr NOx emissions from the Cumulative Emissions above, the cost evaluation follows:

$287,000 / (1.67 – 0.78) = $322,000 per ton.

The CO BACT 1 emissions would be as follows:

(0.10 g/Bhp-hr) X (1148 BHP) / (453.6 g/lb) = 0.253 lb/hr
(0.253 lb/hr) X (8760 hr/yr) / (2000 lb/ton) = 1.11 tons/yr

Using the 6.65 tons/yr CO emissions from the Cumulative Emissions above, the cost evaluation follows:

$287,000 / (6.65 – 1.11) = $51,800 per ton.

Both of these cost per ton values are above the District's $17,500/ton economic evaluation policy. Therefore, it is not cost effective for this source to meet the proposed BACT1 guidelines.

2. Offset Requirements (2-2-302)

Offset credits must be provided for any new or modified source of POC or NO_x emissions at facilities that emit more than 15 tons per year of these pollutants. The District may provide offsets

for facilities with POC or NO_x emissions between 15 and 50 tons per year as long as the facility has no available offset credits and all existing sources of POC and/or NO_x are equipped with Best Available Retrofit Control Technology (BARCT).

Total facility emissions, including this project, will be less than 15 tons per year of POC or NO_X. Therefore, offsets are not required.

3. PSD (Prevention of Significant Deterioration) Requirements (2-2-304)

PSD is triggered if the facility has emissions of 100 tons per year or more of a regulated air pollutant. This facility will emit less than 100 tons per year of pollutants; therefore, PSD does not apply.

C. Particulate Matter and Visible Emissions, Regulation 6

1. Visible Emissions

The engine is subject to and in compliance with the requirements of Regulations 6-301(Ringelmann No. 1 Limitation), 6-302 (Opacity Limitation), 6-305 (Visible Particles), and 6-310 (Particulate Weight Limitation).

D. Inorganic Gaseous Pollutants, Regulation 9

1. Sulfur Dioxide, Regulation 9, Rule 1

The engine is subject to and in compliance with the requirements of Regulations 9-1-301 (Limitations on Ground Level Concentrations), and 9-1-302 (General Emission Limitation).

E. CEQA

This project is to be considered exempt from CEQA review as it qualifies for the ministerial statutory exemption.

VII. PERMIT CONDITIONS

City of Fairfield, Plant Number 1606
1000 Webster Street, Fairfield, CA 94533
Application 6453, Source S-2
Natural Gas Fired Lean Burn IC Engine with CO Oxidation Unit and SCR with Ammonia Catalyst

1. Owner/Operator shall only fire S-2 Engine with natural gas at a firing rate not to exceed 8.4 MMBtu/hr. [Basis: Cumulative Increase]

2. Owner/Operator shall not use more than 735,840 therms of natural gas to fire S-2 Engine in any consecutive twelve (12) month period. [Basis: Cumulative Increase]

3. Owner/Operator shall not operate S-2 Engine unless emissions of nitrogen oxides (NO_x) do not exceed 9.1 lb/day and a concentration of 12 ppmvd at 15% oxygen. [Basis: BACT]

4. Owner/Operator shall not operate S-2 Engine unless emissions of precursor organic compounds (POC) do not exceed 9.1 lb/day and a concentration of 32 ppmvd at 15% oxygen. [Basis: BACT]

5. Owner/Operator shall not operate S-2 Engine unless emissions of carbon monoxide (CO) do not exceed 36.4 lb/day and a concentration of 74 ppmvd at 15% oxygen. [Basis: BACT]

6. Owner/Operator shall not operate S-2 Engine unless emissions of ammonia (NH_3) do not exceed 2.7 lb/day and a concentration of 10 ppmvd at 15% oxygen. [Basis: Cumulative Increase]

7. Owner/Operator shall not operate S-2 Engine unless visible particulate emissions do not exceed Ringelmann 1.0. [Basis: Regulation 6-301]

8. In order to demonstrate compliance with Parts #3, 4, 5, 6 and 7 above, the Owner/Operator shall perform a District approved source test within 60 days of start-up, and annually thereafter, in accordance with the District's Manual of Procedures. The Owner/Operator shall notify the Manager of the District's Source Test Section at least seven (7) days prior to the test, to provide the District staff the option of observing the testing. Within 45 days of test completion, a comprehensive report of the test results shall be submitted to the Manager of the District's Source Test Section for review and disposition. (basis: Regulation 2-1-403).

8. To determine compliance with the above conditions, the Owner/Operator shall maintain the following records and provide all of the data necessary to evaluate compliance with the above conditions, including the following information:

a. Daily records including the following operating data:
   1). The quantity of natural gas (therms) fired at S-2
   2). The quantity of urea injected into the SCR unit
   3). Highest and lowest catalyst temperature for the 24 hr period
   4) The engine output.
   5). The total pounds of NOx, CO, NH_3 and POC emitted based of the abatement system control PLC totalizer or manual calculation based on operating parameters.

b. Monthly records including the following operating data:
   1). The number and duration (hours) of shutdowns and startups
   2). The total fuel gas usage (a sum of the daily amounts)

c. Monthly records shall be totaled for each consecutive 12-month period.

d. All records shall be retained on site for two years, from the date of entry, and made available for inspection by District staff upon request. These recordkeeping requirements shall not replace the recordkeeping requirements contained in any applicable District Regulations.

VIII. RECOMMENDATIONS

It is recommended that an Authority to Construct be issued to the City of Fairfield for the following:

S-2 Natural Gas Fired Lean Burn IC Engine with CO Oxidation Unit and SCR with Ammonia Catalyst

By: _____ Date:_____